2021 Annual Groundwater Monitoring and Corrective Action Report

for Compliance with the Coal Combustion Residuals (CCR) Rule

Comanche Station

Public Service Company of Colorado

January 31, 2022

Table of Contents

List of Tables

List of Figures

List of Appendices

Table of Abbreviations and Acronyms

Abbreviation	Definition
BTV	background threshold value
CCR	Coal Combustion Residuals
COI	constituent of interest
EPA	Environmental Protection Agency
LCS	Laboratory Control Samples
MS/MSD	Matrix Spike/Duplicate
QC	quality control
PSCo	Public Service Company of Colorado
RPD	Relative Percent Difference
SOP	Standard Operating Procedure
SSI	statistically significant increase
SSL	statistically significant level
TDS	Total Dissolved Solids
TSS	Total Suspended Solids

Certification

2021 Groundwater Monitoring Annual Report for Comanche Station

I hereby certify to the best of my knowledge that this groundwater monitoring annual report is designed to meet the performance standard in 40 CFR Part 257 of the Federal Coal Combustion Residuals (CCR) Rule.

I am duly licensed Professional Engineer under the laws of the State of Colorado.

31-JAN-2022

Matthew Rohr, PE
Colorado PE License 0053467
License renewal date October 31, 2023

Summary of 40 CFR Section § 257.90(e)(6) Groundwater Monitoring System Requirements and Site-Specific Compliance at Comanche Station			
§ 257.90(e)(6) *A section at the beginning of the annual report that provides an overview of the current status of groundwater monitoring and corrective action programs for the CCR unit. At a minimum, the summary must specify all of the following:*		**Bottom Ash Impoundment (Ceased Waste Disposal on June 18, 2021)**	**Landfill (Active)**
§257.90(e)(6)(i)	*At the start of the current annual reporting period, whether the CCR unit was operating under the detection monitoring program in § 257.94 or the assessment monitoring program in § 257.95.*	Detection Monitoring Program	Detection Monitoring Program
§257.90(e)(6)(ii)	*At the end of the current annual reporting period, whether the CCR unit was operating under the detection monitoring program in § 257.94 or the assessment monitoring program in § 257.95.*	Assessment Monitoring Program	Detection Monitoring Program
§257.90(e)(6)(iii)	*If it was determined that there was a statistically significant increase over background for one or more constituents listed in appendix III to this part pursuant to § 257.94(e):*	Yes	Yes
§257.90(e)(6)(iii)(A)	*Identify those constituents listed in appendix III to this part and the names of the monitoring wells associated with such an increase.*	• W-1 – boron, pH • W-3 – pH • W-4 – pH • W-5 – pH • W-5B – pH • W-6 – boron, pH • W-9 – pH (perimeter well)	• MW-4B – calcium (cross-gradient)
§257.90(e)(6)(iii)(B)	*Provide the date when the assessment monitoring program was initiated for the CCR unit.*	April 6, 2021	N/A (ASD August 24, 2021)
§257.90(e)(6)(iv)	*If it was determined that there was a statistically significant level above the groundwater protection standard for one or more constituents listed in appendix IV to this part pursuant to § 257.95(g) include all of the following:*	Yes	N/A
§257.90(e)(6)(iv) (A)	*Identify those constituents listed in appendix IV to this part and the names of the monitoring wells associated with such an increase.*	• W-6 – molybdenum • W-7 – cobalt (perimeter well)	N/A
§257.90(e)(6)(iv) (B)	*Provide the date when the assessment of corrective measures was initiated for the CCR unit.*	Must be initiated by February 13, 2022	N/A
§257.90(e)(6)(iv)(C)	*Provide the date when the public meeting was held for the assessment of corrective measures for the CCR unit.*	N/A	N/A
§257.90(e)(6)(iv)(D)	*Provide the date when the assessment of corrective measures was completed for the CCR unit.*	N/A	N/A
§257.90(e)(6)(v)	*Whether a remedy was selected pursuant to § 257.97 during the current annual reporting period, and if so, the date of remedy selection.*	N/A	N/A
§257.90(e)(6)(vi)	*(vi) Whether remedial activities were initiated or are ongoing pursuant to § 257.98 during the current annual reporting period.*	N/A	N/A

1.0 Introduction

The U.S. Environmental Protection Agency's (EPA's) final Coal Combustion Residuals (CCR) Rule establishes comprehensive a set of requirements for the management and disposal of CCR (or coal ash) in landfills and surface impoundments by electric utilities. Comanche Station, located in Pueblo, Colorado (**Figure 1)** is owned and operated by Public Service Company of Colorado (PSCo), an Xcel Energy Company. Comanche Station has two CCR units, an impoundment (Bottom Ash Pond) and an ash disposal facility (Landfill) (**Figure 2**) that are subject to certain requirements of the CCR Rule. PSCo ceased waste disposal at the Bottom Ash Pond in June 2021.

Per the CCR Rule, groundwater monitoring is required to monitor potential impacts to the uppermost aquifer. PSCo established a monitoring network as described in Comanche Groundwater Monitoring System Certification and completed eight rounds of background sampling between 2015 and 2017 (HDR, 2018). The 2018 certified monitoring network included existing and newly installed wells at the Bottom Ash Pond and at the landfill in 2017. All wells were screened in the colluvium, based upon the conceptual site model at that time
In 2020, a phased drilling program was initiated to further evaluate site hydrogeologic conditions to support an alternate liner demonstration under the EPA CCR Part B Final Rule (November 12, 2020) (40 CFR 257.71(d)). The evaluation resulted in installation of fourteen new monitoring wells primarily in the weathered shale (uppermost Pierre Shale). Monitoring completed in 2020 determined that the uppermost groundwater beneath the site is within the weathered shale that lies below the colluvium, and above consolidated, unfractured and thick, shale, and the new wells were added to the certified monitoring network.

This Annual Groundwater Monitoring Report presents the sampling and analysis completed in 2021:

- The status of the groundwater monitoring program for the Bottom Ash Pond at the end of 2021 is in assessment monitoring and initiating an assessment of corrective measures.
- The status of the groundwater monitoring program for the landfill at the end of 2021 is in detection monitoring.

In 2022 PSCo intends to continue the sampling and analysis program following the CCR Rule groundwater monitoring program requirements in 40 CFR 257.93-95 as well as performing an assessment of corrective measures and begin the process of Remedy Selection at the Bottom Ash Pond.

2.0 Facility Description

Comanche Station is a coal-fired plant consisting of three units (Units 1, 2, 3) that burn Powder River Basin coal. Unit 1 was built in 1973, Unit 2 was built in 1975, and Unit 3 was built in 2010 (Tetra Tech, 2012). Comanche Station currently has two CCR units subject to the CCR Rule: a landfill and an impoundment (**Figure 2**). The sections that follow provide a brief description of the CCR units.

The Landfill, also known as the CCR Ash Disposal Facility (**Figure 2**), is an engineered ash monofill consisting of two disposal cells with a combined area of approximately 55 acres. Cell 1 was constructed in 1987 with a clay liner and Cell 2E was constructed with a composite liner system and leachate collection system compliant with the CCR Rule. Additional disposal cells have been permitted and will be constructed in phases as needed to dispose of ash and other approved waste from power generating activities. Fly ash from all three units is collected in silos for disposal in the landfill. Bottom ash is also permitted to be disposed in the on-site landfill. Water treatment sludge (lime from an on-site treatment system), process water pond sediment, coal impurities, and excavation soils are also permitted for disposal at the landfill (Tetra Tech, 2015).

Bottom ash generated from Units 1 and 2 was previously sluiced to the Bottom Ash Pond for dewatering and temporary storage. Bottom ash solids were routinely excavated from the impoundment and either beneficially used off-site or transported to the landfill for disposal. Bottom ash is removed from Unit 3 dry via a submerged flight conveyor and does not go into the Bottom Ash Pond; it is transported dry either to off-site beneficial use or to the landfill for disposal. According to historic documents, the impoundment was constructed in 1972 with a three-foot thick clay liner. The impoundment is partially incised and is 513 feet long by 138 feet wide and 26 feet deep with a surface area of 1.6 acres. The primary influent to the CCR impoundment was sluiced bottom ash, with lesser quantities of economizer ash, and pyrites and non-CCR wastewater. The CCR impoundment effluent historically discharged to the polishing pond immediately east of the Bottom Ash Pond (**Figure 2**) and the polishing pond discharges under Colorado Discharge Permit System (CDPS) Permit No. CO0000612.

In 2021, a sluice water treatment system was designed and constructed to permanently replace the Bottom Ash Pond. The treatment system bypasses the Bottom Ash Pond, provides treatment for all CCR and non-CCR waste streams that previously discharged to the Bottom Ash Pond, and ultimately discharges to the polishing pond. The treatment system is designed and operated to provide effluent water quality meeting the requirements of the CDPS Permit. With the treatment system in service, the Bottom Ash Pond ceased taking receipt of CCR waste streams in June 2021.

Additional ponds at the facility include process water, settling, polishing, and raw water storage ponds. These ponds do not receive CCR, and therefore are not subject to the CCR Rule. The operation and monitoring of all the CCR units are described further in the Comanche Station Groundwater Monitoring System Certification (HDR, 2018).

2.1 Hydrogeology

Comanche Station is underlain by unconsolidated colluvium consisting of stiff clays and silts. Typical colluvium thickness is approximately 20 feet but ranges between 5 and 75 feet (Woodward-Clyde, 1987; URS, 2005). At the southern property boundary and west and south of the CCR landfill, alluvial sand and gravels are interbedded with the colluvium. The colluvium overlies the Pierre Shale bedrock at the Comanche Station. The Pierre Shale is a low-permeability shale deposit that is 1,450 feet thick in this area. It consists of primarily bentonitic shales, with some minor chalk and limestone deposits interbedded within the shale and has a

measured hydraulic conductivity of 3E-10 to 3E-07 centimeters per second (cm/sec). Underlying the shale deposits is the Dakota Sandstone Formation, which is recognized as a regional aquifer in this area.

Multiple hydrogeologic studies completed at the Comanche site concluded that the shale deposit beneath the site is effectively impermeable. Based on this conceptual site model the monitoring well network prior to 2020 was established to monitor the colluvium, with screened intervals in the colluvium and well bottoms at the colluvium/shale contact. Consistent with prior studies, the shallow unconsolidated colluvium deposits beneath the site were observed by HDR between 2015 and 2020 to be predominantly dry, with some isolated areas of perched water.

As discussed in more detail in the 2020 annual groundwater report and the 2021 updated groundwater monitoring system certification report, in 2020, PSCo conducted an investigation to further characterize the Pierre Shale (HDR, 2021; HDR, 2021b). Borings were completed using core drilling and advanced through the weathered shale and into the consolidated shale. The data from this investigation was incorporated into an updated hydrogeologic conceptual site model and in August and December 2020, new monitoring wells were installed primarily in the weathered shale around the Landfill, at the bottom ash pond, around the site perimeter, and to the northeast of the ponds. Monitoring in 2020 indicated that groundwater is present in the weathered shale and appears to have greater lateral continuity than that observed in the colluvium. Slug testing on the wells produced estimated hydraulic conductivity values resulting in a geomean hydraulic conductivity of 2.52E-04 cm/s in the weathered bedrock and geomean hydraulic conductivity of 4.07E-05 in the colluvium. The updated conceptual site model suggests that the uppermost groundwater beneath the site is in the weathered shale unit; however, in the vicinity of the ponds, there is groundwater observed in the colluvial screened wells. All other wells screened in the colluvium around the site, and geotechnical borings drilled into the colluvium indicate the colluvium is dry. As evidenced through core drilling around the site, the weathered shale is above unfractured, low permeability shale that is referred to as consolidated shale. The thickness of the groundwater unit above the consolidated shale ranges from less than one foot (0.85 foot) to 24.69 feet.

Appendix A displays groundwater contour maps in January, May, and December 2021. The contour maps display the potentiometric surface contours for wells screened in the weathered shale. Evaluating the groundwater elevations in wells screened in the weathered shale across the site, a continuous groundwater surface appears to flow south and southeast under the Bottom Ash Pond and Landfill, respectively. In response to the observations recorded in 2020 from wells completed in weathered shale and the identification of an upper groundwater unit above the consolidated shale, PSCo installed four additional monitoring wells in November 2021, that will be added to the Groundwater Monitoring Network Certification report in 2022 (**Figure 2**):

- MW-7 – A downgradient well screened in the weathered shale, located at the southeast side of the Landfill;
- W-3B - A downgradient well screened in the weathered shale, located at the south side of the Bottom Ash Pond;

- W-6B - A downgradient well screened in the weathered shale, located at the southeast side of the Bottom Ash Pond; and
- W-2C - An upgradient well screened in the weathered shale, located northeast of the Bottom Ash Pond, adjacent to existing upgradient well W-2A.

The groundwater travel time to the Dakota Sandstone aquifer has not changed in the new conceptual site model. With regard to horizontal flow of perched water, the distance from the Bottom Ash Pond to the St. Charles River is approximately 4,000 feet and the nearest potentially downgradient offsite domestic wells are located south and southeast of the Station at approximately 3,300 and 3,950 feet, both screened in alluvium associated with the St. Charles River. Assuming the hydraulic conductivity of the weathered shale as measured in slug tests in 2020 ($2.52E10^{-4}$ cm/s), the potential for lateral migration of groundwater is 50 feet per year. Therefore, it would take on the order of 70 to 140 years for groundwater under the Bottom Ash Pond to travel to the nearest domestic well or 85 to 169 years to reach the St. Charles River.

2.2 Monitoring Well Network

Wells were installed in 2020 and 2021 screened in the weathered shale and the conceptual site model has been updated such that the well network monitors the uppermost groundwater in the weathered shale. Some existing wells screened in colluvium also remain in the monitoring network.

PSCo published an update Groundwater Monitoring Network Certification on June 28, 2021, which includes wells installed in August and December 2020. In November 2021, PSCo installed four monitoring wells that will be added to the certified groundwater monitoring network, MW-7, W-2C, W-3B, and W-6B. An updated Groundwater Monitoring System Certification will be developed in early 2022. There were no wells abandoned or modified in 2021. The well network for each facility is described below.

2.2.1 Landfill/ Ash Disposal Facility

In November 2021, one new well for the landfill, MW-7, was installed at the southeast edge of the landfill waste boundary (**Figure 2**). The well was screened in the weathered shale and serves as a downgradient well for the landfill.

There are ten wells in the certified groundwater monitoring network for the landfill, but only seven of them produce water: MW-1B, MW-2B, MW-3, MW-4B, MW-5, MW-6, and MW-7 (**Figure 2**) (HDR, 2021). All of these wells are screened to collect groundwater in the weathered shale. Wells MW-1, MW-2, and MW-4 are also in the network of wells but are screened in the colluvium above the weathered shale and are consistently dry. However, they continue to be monitored. The upgradient background wells are MW-3 and MW-5, and the primary downgradient wells are MW-1B, MW-2B, and MW-7. Wells MW-4B and MW-6 are still in the monitoring network, but groundwater flow directions indicate these two wells are upgradient to cross gradient of the landfill.

2.2.2 Impoundment/ Bottom Ash Pond

The certified monitoring network for the Bottom Ash Impoundment includes the following wells (**Figure 2**):

- Background wells: W-2, W-2A, W-2C
- Downgradient compliance wells (wells to evaluate for potential impacts at and near the CCR unit waste boundary): W-1, W-3, W-3B, W-4, W-5, W-5B, W-6, W-6B

Background Wells

W-2 (installed in 1997) is located northeast of the settling ponds near the eastern boundary of the property and was evaluated as a potential upgradient background well; however, it is screened in colluvium and has historically been dry (Error! Reference source not found.).

Well W-2A was drilled in August 2020 and is screened in and monitors groundwater in the weathered shale upgradient of the ponds and therefore is the background well for the Bottom Ash Impoundment. Well W-2B (**Figure 2**) is screened in the consolidated shale and therefore the water quality is not appropriate for comparison against the upper groundwater and is not part of the certified monitoring well network.

Well W-2C serves as an additional background well for the Bottom Ash Pond. It is adjacent to the existing background well W-2A, also screened in the weathered shale. This new monitoring well was installed in response to observations that the W-2A filter pack extending into the shale-derived clay above the weathered shale. However, because groundwater levels are within the screened interval of W-2A in weathered shale PSCo anticipates the water quality results from W-2A and W-2C will be very similar.

Downgradient Wells

Wells W-1 and W-3 (installed in 1997) and W-4, W-5, and W-6 (installed in 2015) are screened in the colluvium but remain in the monitoring network as downgradient wells for the Bottom Ash Impoundment. These wells will continue to be monitored because they provide water quality of the uppermost groundwater around the pond and insight into the potential for pond leakage to impact groundwater.

Well W-5B was drilled in December 2020, adjacent to W-5 but deeper and screened in the weathered shale to evaluate groundwater quality differences between colluvium and weathered shale. W-5B was added to the certified network to monitor groundwater in the weathered shale.

Wells W-3B and W-6B were installed in November 2021 as additional downgradient waste boundary wells screened in the weathered shale. They are located close to existing colluvial wells W-3 and W-6.

Wells that are historically dry (W-2 and often W-4) continue to be checked for water levels and if sufficient water is available for sampling these wells are sampled.

2.2.3 Perimeter/Characterization Wells

No new perimeter or characterization wells were installed in 2021. The following section described the existing perimeter wells in monitoring network. All of these wells monitor groundwater conditions in the weathered shale away from the CCR units at or near the site

property boundaries in the downgradient flow direction to the south and east. Error! Reference source not found.).

Monitoring wells W-7, W-8A, and W-8B were installed in August 2020, and W-9, W-11, W-12, W-13 were installed in December 2020. Wells W-7 and W-9 are screened in the weathered shale. W-8A was screened in the alluvium and weathered shale, but was found to be dry. W-8B was drilled adjacent to W-8A and was screened in the consolidated shale, also found to be effectively dry. Wells W-11, W-12, and W-13 were installed south of the Raw Water Pond and in the direction of the southern property boundary. These wells (W-11 through W-13) are all screened in the weathered shale. Well W-13 was found to be dry.

Test hole borings TH-184 and TH-185 were installed in 1987 for a geotechnical study and field located in 2020 just south of W-11, W-12, and W-13, and will be monitored for water levels (Error! Reference source not found.). These two wells are screened in the colluvium and are dry. These wells along the southern edge capture water quality at a greater distance from the CCR units to evaluate potential effects of the units on surrounding areas to the south and southeast.

Wells W-10A and W-10B were drilled in December 2020 to evaluate depth to groundwater as a geotechnical design constraint for new facilities planned for construction in 2021. Well W-10A is screened in the colluvium and is dry, and W-10B is screened in weathered shale and has groundwater. The location provides valuable additional data for the groundwater potentiometric mapping and will be monitored for water levels only.

PSCo has updated the certified groundwater monitoring network to include some perimeter wells in order to evaluate the potential for groundwater moving offsite. The following perimeter wells are included in the certified monitoring network:

- Wells to evaluate water quality further downgradient of the Bottom Ash Pond compliance wells: W-7, W-8A, W-9, W-11, W-12, and W-13.
- Wells to evaluate water quality further downgradient of the Landfill compliance wells: W-11, W-12, and W-13 (these three wells are also compared to the Bottom Ash Pond background).
- W-10A, W-10B, and test hole borings TH-184 and TH-185 will be monitored for water levels only.

Wells W-8A and W-13 are historically dry and will continue to be checked for water levels and if sufficient water is available for sampling these wells will be sampled. Well W-8B is not included in the network because it was screened in the consolidated shale and was effectively dry.

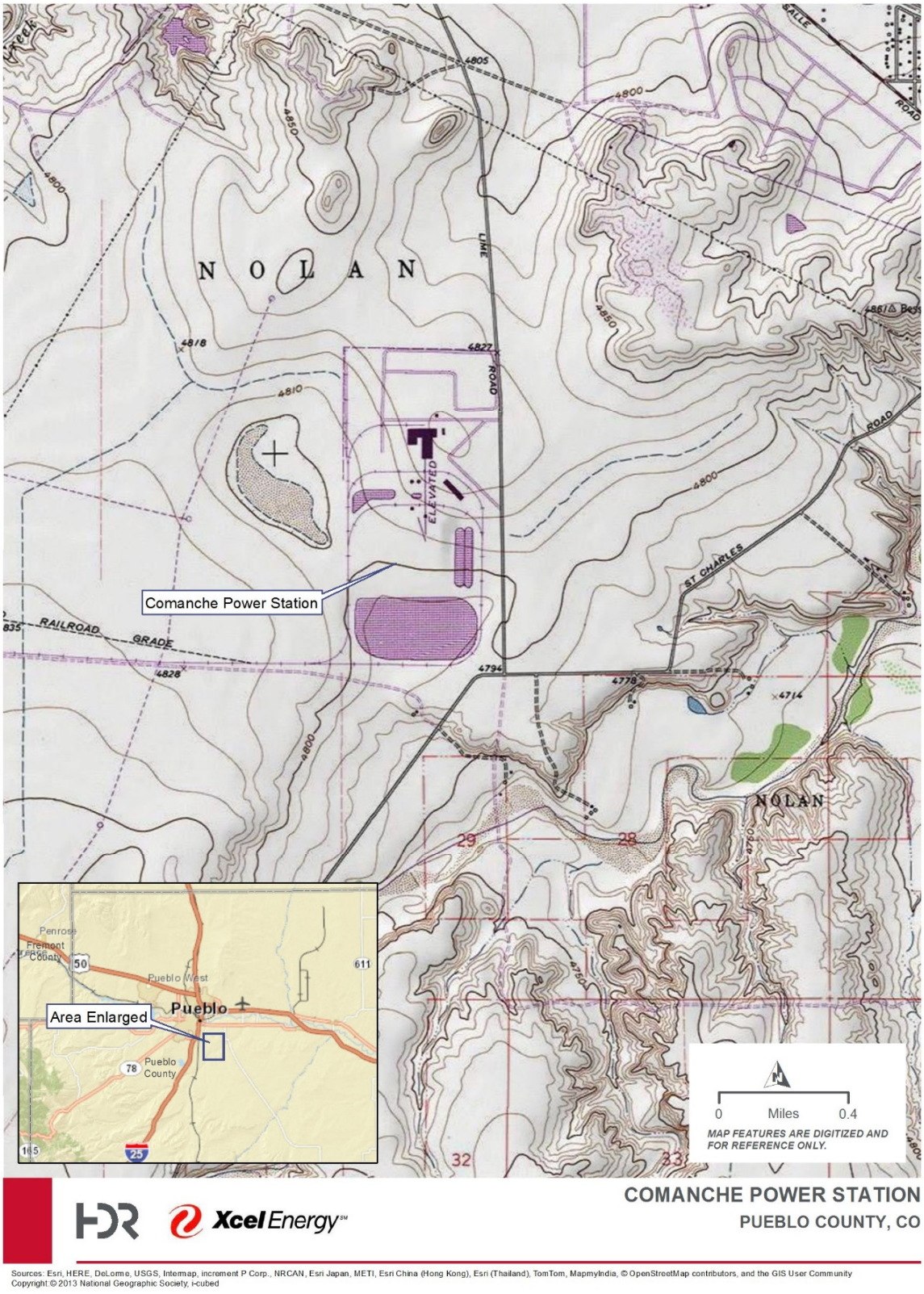


Figure 1. Vicinity Map for Comanche Station

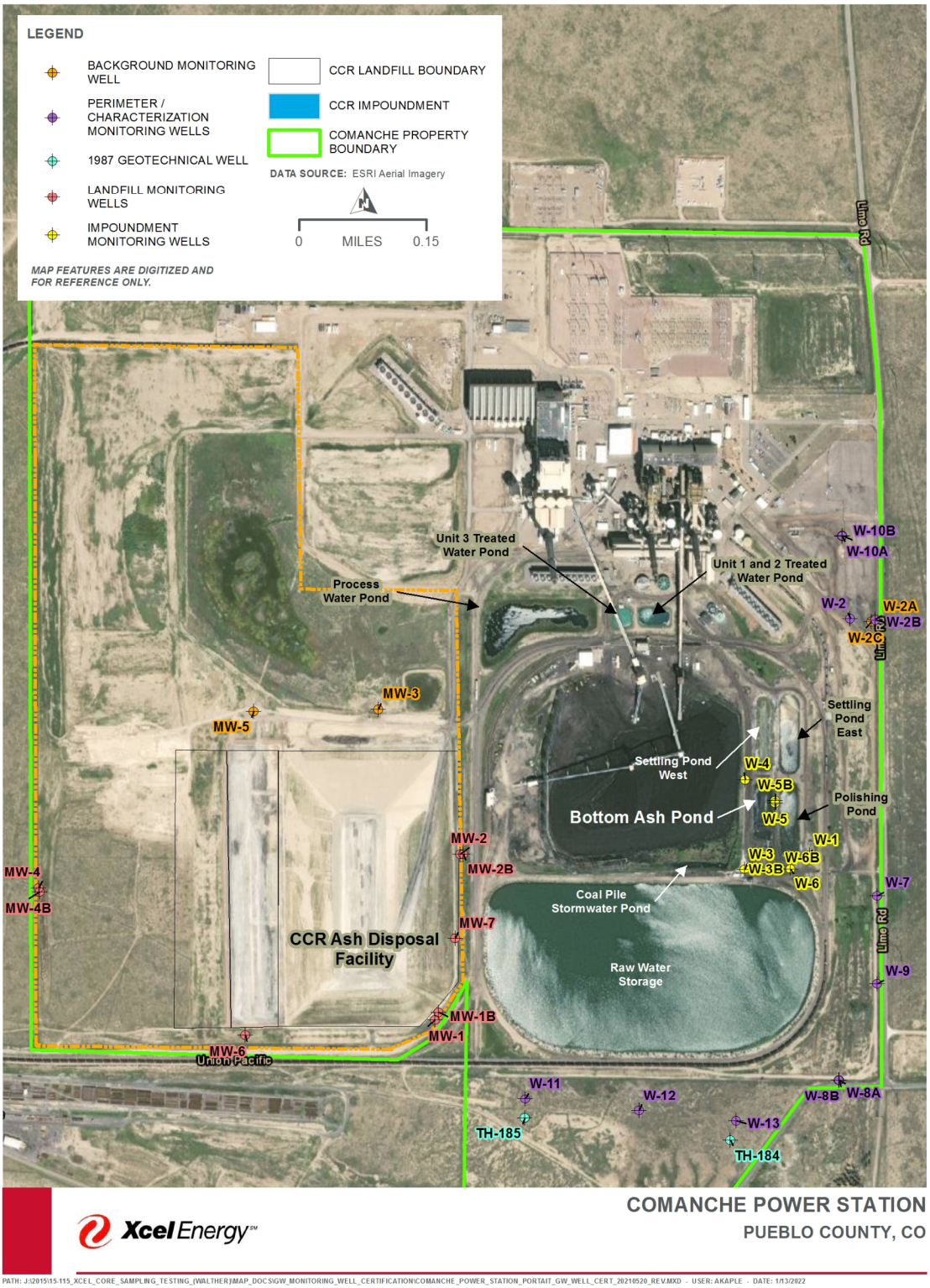


Figure 2. Comanche Station – CCR units and monitoring well location map.

3.0 Monitoring

3.1 Frequency

Groundwater monitoring for both CCR units was conducted quarterly between fourth quarter 2015 and third quarter 2017 to represent background water quality in the colluvial groundwater, based upon the original conceptual site model. Beginning in 2020, based upon the updated conceptual site model, monitoring has included the wells in the updated network that monitor groundwater in the weathered shale. Eight rounds of background sampling were collected from all non-dry wells in the updated certified network from August 2020 through December 2020 and analyzed for all Appendix III and IV constituents plus TSS (**Table 1**), and background threshold values (BTVs) were developed.

3.1.1 Landfill/ Ash Disposal Facility

The first detection monitoring sample event at the landfill occurred in January 2021. In the May 26, 2021 PSCo memorandum, *Determination of Statistically Significant Increases over Background per 257.93(h)(2)*, concentrations of Appendix III COIs from downgradient monitoring wells at the Landfill were compared against the BTVs and shown to have SSIs over BTVs (upper prediction limit). The SSIs triggered the assessment monitoring program but PSCo completed an Alternative Source Determination for the Landfill. Detection monitoring continues semi-annually to sample all of the monitoring wells around the landfill for Appendix III constituents (**Table 1**). **Table 2** provides the well identification, number of samples collected, dates samples were collected in 2021, and the CCR Rule monitoring purpose.

Table 1. Groundwater quality parameters	
Appendix III Constituents	**Appendix IV Constituents**
Boron	Antimony
Calcium	Arsenic
Chloride	Barium
Fluoride	Beryllium
pH	Cadmium
Sulfate	Chromium
Total Dissolved Solids (TDS)	Cobalt
Additional Parameters	Fluoride
Total Suspended Solids (TSS)	Lead
	Lithium
	Mercury
	Molybdenum
	Selenium
	Thallium
	Radium 226 and 228 combined

Table 2. Number and dates of groundwater samples collected for each well and the required monitoring programs for the Comanche Landfill/ Ash Disposal Facility (257.90(e)(3))

Monitoring Well I.D.[1]	Well Location	Dates Monitored	CCR Rule Monitoring Purpose
MW-1	Downgradient	January 6, 2021*	Detection Monitoring
		April 6, 2021*	Initial Assessment Monitoring Event before ASD complete
		May 25, 2021*	Second Assessment Monitoring Event before ASD complete
		November 18, 2021*	Detection Monitoring
MW-1B	Downgradient	January 12, 2021	Detection Monitoring
		April 13, 2021	Initial Assessment Monitoring Event before ASD complete
		May 25, 2021	Second Assessment Monitoring Event before ASD complete
		November 18, 2021	Detection Monitoring
MW-2	Downgradient	January 6, 2021*	Detection Monitoring
		April 6, 2021*	Initial Assessment Monitoring Event before ASD complete
		May 26, 2021*	Second Assessment Monitoring Event before ASD complete
		November 18, 2021*	Detection Monitoring
MW-2B	Downgradient	January 13, 2021	Detection Monitoring
		April 9, 2021	Initial Assessment Monitoring Event before ASD complete
		May 26, 2021	Second Assessment Monitoring Event before ASD complete
		November 18, 2021	Detection Monitoring
MW-3	Upgradient / Background	January 12, 2021	Detection Monitoring
		April 7, 2021	Initial Assessment Monitoring Event before ASD complete
		May 25, 2021	Second Assessment Monitoring Event before ASD complete
		November 16, 2021	Detection Monitoring
MW-4	Cross-gradient	January 6, 2021*	Detection Monitoring
		April 6, 2021*	Initial Assessment Monitoring Event before ASD complete
		May 25, 2021*	Second Assessment Monitoring Event before ASD complete
		November 18, 2021*	Detection Monitoring
MW-4B	Cross-gradient	January 13, 2021	Detection Monitoring
		April 13, 2021	Initial Assessment Monitoring Event before ASD complete
		May 25, 2021	Second Assessment Monitoring Event before ASD complete
		November 18, 2021	Detection Monitoring
MW-5	Upgradient / Background	January 12, 2021	Detection Monitoring
		April 12, 2021	Initial Assessment Monitoring Event before ASD complete

Table 2. Number and dates of groundwater samples collected for each well and the required monitoring programs for the Comanche Landfill/ Ash Disposal Facility (257.90(e)(3))

Monitoring Well I.D.[1]	Well Location	Dates Monitored	CCR Rule Monitoring Purpose
		May 26, 2021	Second Assessment Monitoring Event before ASD complete
		November 18, 2021	Detection Monitoring
MW-6	Cross-gradient	January 12, 2021	Detection Monitoring
		April 6, 2021	Initial Assessment Monitoring Event before ASD complete
		May 26, 2021	Second Assessment Monitoring Event before ASD complete
		November 18, 2021	Detection Monitoring
MW-7 (Installed November 11, 2021)	Downgradient	December 8, 2021	Detection Monitoring

[1]MW-1B, MW-2B, and MW-4B were installed adjacent to MW-1, MW-2, and MW-4, respectively, in August 2020. The wells were drilled deeper because the original wells were historically dry. The water levels of the original wells were measured if water was present, but they were not sampled and remained dry.
*Well was monitored and found to be dry, no sample could be collected

3.1.2 Bottom Ash Pond

The first detection monitoring sample event at the Bottom Ash Pond occurred in January 2021. In the May 26, 2021 PSCo memorandum, *Determination of Statistically Significant Increases over Background per 257.93(h)(2)*, concentrations of Appendix III COIs from downgradient monitoring wells at the Bottom Ash Impoundment were compared against the BTVs and shown to have SSIs over BTVs (upper prediction limit). The SSIs triggered the assessment monitoring program for the Bottom Ash Pond. The initial assessment monitoring event for the Bottom Ash Pond was completed in April 2021 to sample all of the monitoring wells for Appendix IV constituents (**Table 1**). In May 2021, the second assessment monitoring samples were collected from Bottom Ash Pond wells. Samples were analyzed for Appendix III and detected Appendix IV COIs plus TSS. **Table 2** provides the well identification, number of samples collected, dates samples were collected in 2021, and the CCR Rule monitoring purpose.

Table 3. Number and dates of groundwater samples collected for each well and the required monitoring programs for the Comanche Bottom Ash Impoundment (257.90(e)(3))			
Monitoring Well I.D.	**Well Location**	**Dates Monitored**	**CCR Rule Monitoring Purpose**
W-1	Downgradient	January 14, 2021	Detection Monitoring
		April 7, 2021	Initial Assessment Monitoring
		June 2, 2021	Semi-Annual Assessment Monitoring Event
		December 8, 2021	Annual Assessment Monitoring Event
W-2[1]	Upgradient / Background	January 6, 2021*	Detection Monitoring
		April 6, 2021*	Initial Assessment Monitoring
		May 25, 2021*	Semi-Annual Assessment Monitoring Event
		November 29, 2021*	Annual Assessment Monitoring Event
W-2A	Upgradient / Background	January 13, 2021	Detection Monitoring
		April 6, 2021	Initial Assessment Monitoring
		May 26, 2021	Semi-Annual Assessment Monitoring Event
		November 30, 2021	Annual Assessment Monitoring Event
W-2B	Site-wide Characterization	January 13, 2021*	Characterization Monitoring
		April 7, 2021	Characterization Monitoring
		May 26, 2021	Characterization Monitoring
		November 29, 2021*	Characterization Monitoring
W-2C (Installed November 8, 2021)	Upgradient / Background	December 9, 2021	Background Monitoring
W-3	Downgradient	January 13, 2021	Detection Monitoring
		April 9, 2021	Initial Assessment Monitoring
		May 27, 2021	Semi-Annual Assessment Monitoring Event
		December 1, 2021	Annual Assessment Monitoring Event
W-3B (Installed November 23, 2021)	Downgradient	December 10, 2021	Detection Monitoring
W-4	Cross-gradient	January 14, 2021	Detection Monitoring
		April 19, 2021	Initial Assessment Monitoring
		May 25, 2021*	Semi-Annual Assessment Monitoring Event
		November 29, 2021*	Annual Assessment Monitoring Event
W-5	Downgradient	January 12, 2021	Detection Monitoring
		April 6, 2021	Initial Assessment Monitoring
		June 2, 2021	Semi-Annual Assessment Monitoring Event
		December 1, 2021	Annual Assessment Monitoring Event

Table 3. Number and dates of groundwater samples collected for each well and the required monitoring programs for the Comanche Bottom Ash Impoundment (257.90(e)(3))			
Monitoring Well I.D.	**Well Location**	**Dates Monitored**	**CCR Rule Monitoring Purpose**
W-5B	Downgradient	January 14, 2021	Detection Monitoring
		April 9, 2021	Initial Assessment Monitoring
		May 26, 2021	Semi-Annual Assessment Monitoring Event
		December 1, 2021	Annual Assessment Monitoring Event
W-6	Downgradient	January 12, 2021	Detection Monitoring
		April 9, 2021	Initial Assessment Monitoring
		May 25, 2021	Semi-Annual Assessment Monitoring Event
		November 30, 2021	Annual Assessment Monitoring Event
W-6B (Installed November 9, 2021)	Downgradient	December 9, 2021	Detection Monitoring
W-7	Perimeter/ Characterization Well	January 14, 2021	Detection Monitoring
		April 12, 2021	Initial Assessment Monitoring
		May 27, 2021	Semi-Annual Assessment Monitoring Event
		December 1, 2021	Annual Assessment Monitoring Event
W-8A	Perimeter/ Characterization Well	January 6, 2021*	Detection Monitoring
		April 6, 2021*	Initial Assessment Monitoring
		May 25, 2021*	Semi-Annual Assessment Monitoring Event
		November 29, 2021*	Annual Assessment Monitoring Event
W-9	Perimeter/ Characterization Well	January 12, 2021	Detection Monitoring
		April 19, 2021	Initial Assessment Monitoring
		May 27, 2021	Semi-Annual Assessment Monitoring Event
		November 30, 2021	Annual Assessment Monitoring Event
W-10A	Perimeter/ Characterization Well	January 6, 2021*	Water Level
		April 6, 2021*	Water Level
		May 25, 2021*	Water Level
		November 29, 2021*	Water Level
W-10B	Perimeter/ Characterization Well	January 12, 2021	Water Level
		April 13, 2021	Water Level
		June 2, 2021	Water Level
		December 2, 2021	Water Level
W-11	Perimeter/ Characterization Well	January 13, 2021	Detection Monitoring

Table 3. Number and dates of groundwater samples collected for each well and the required monitoring programs for the Comanche Bottom Ash Impoundment (257.90(e)(3))			
Monitoring Well I.D.	**Well Location**	**Dates Monitored**	**CCR Rule Monitoring Purpose**
		April 12, 2021	Initial Assessment Monitoring
		May 27, 2021	Semi-Annual Assessment Monitoring Event
		December 2, 2021	Annual Assessment Monitoring Event
W-12	Perimeter/ Characterization Well	January 13, 2021	Detection Monitoring
		April 12, 2021	Initial Assessment Monitoring
		May 28, 2021	Semi-Annual Assessment Monitoring Event
		December 2, 2021	Annual Assessment Monitoring Event
W-13	Perimeter/ Characterization Well	January 6, 2021*	Detection Monitoring
		April 6, 2021*	Initial Assessment Monitoring
		May 25, 2021*	Semi-Annual Assessment Monitoring Event
		November 29, 2021*	Annual Assessment Monitoring Event

[1]W-2A was installed adjacent to W-2 in August 2020. The new well were drilled deeper because the original well was historically dry. Water levels and samples are taken from W-2 if/when enough water is present.
*Well was monitored and found to be dry, no sample could be collected.

3.2 Water Levels and Sample Collection

Water levels were collected in each well prior to sample collection. Groundwater sample collection protocols follow the Groundwater Sample Collection Standard Operating Procedure (SOP) (HDR, 2015). The water samples were collected using a bladder pump or bailer (only when water levels were too low in the well), and the equipment was decontaminated between wells following protocols outlined in the Sampling SOP. Each well was purged until field parameters stabilized in accordance with the sampling SOP. In accordance with the CCR Rule, groundwater samples were not field filtered. The field parameters of turbidity, pH, and temperature were measured using a YSI Professional Plus (or an equivalent) portable water quality instrument that was calibrated prior to use each day of sampling. The results of field measurements were recorded on a field data form, which is maintained as part of the field sampling records. If the turbidity of the groundwater during purging and stabilization remained above 10 NTU, a sample was collected for lab filtering and dissolved metals analysis. For quality control, one field duplicate sample and one field equipment blank sample was collected during each sample event. Water samples were delivered under Chain of Custody to Eurofins Test America in Denver, Colorado.

3.3 Analytical Testing

Groundwater samples for each type of monitoring were analyzed for the constituents of interest (COIs) shown in Appendix B. Background monitoring analyses include all the parameters in Appendices III and IV of CCR Rule Part 257, plus TSS. The laboratory analyzed matrix spike/matrix spike duplicates at a rate of 5 percent, per laboratory quality control procedures.

3.4 Data Validation and Data Management

Data validation and data management tasks were performed per the Data Management and Statistical Procedures Plan for Compliance with the Coal Combustion Residuals Rule (HDR, 2019a). Data validation was conducted to eliminate data that did not meet validation criteria and designate a data qualifier for any data quality limitation discovered.

All samples and quality control (QC) were reviewed and evaluated, and no samples were rejected. Most QC analyses were within reportable limits; however, when QC was outside control limits, samples were reported as estimated. Data analyses required minimal qualifications, and all data were usable, even when qualified.

Relative percent difference (RPD) results for field duplicate analyses were generally within the control limit criterion of 20%. Outliers were identified for metals (four instances), TSS (four instances), anions (one instance~~s~~), and radiochemical (two instances).

RPD results for lab duplicate analyses were generally within the control limit criterion of 20%. Outliers were identified for TDS (one instance), TSS (two instances), and pH (one instance). Laboratory Control Sample (LCS)/LCS duplicate recoveries were generally within control limits. Outliers were identified for Ra-228 (one instance, where recoveries were above the project control limits but associated sample results were non-detect). Matrix Spike/Duplicate (MS/MSD) recoveries were generally within control limits. Outliers were identified for anions (four instances) and metals (ten instances – seven of which were different metals from one MS/MSD analysis and the parent sample required qualification). LCS/LCSD RPDs were all within control limits except TSS in one instance. MS/MSD RPDs were generally within control limits. Outliers were identified for anions (one instance).

4.0 Monitoring Results

4.1 Water Levels and Groundwater Flow Direction

The water levels at monitoring wells were recorded during monitoring events and are shown in **Table 4**. Potentiometric contour maps were created for water level measurements collected from the wells in the existing monitoring network in January, May, and December 2021 (**Appendix A**). The groundwater flow direction in the weathered shale is generally south, though under the Landfill there is variability and flow appears to be coming from east, west, and north and heading south. Maps were made only using wells screened in the weathered shale.

Table 4. Groundwater elevations measured in 2021					
Well ID	**TOC Elevation (ft amsl)**	**CCR Unit**	**Groundwater Elevation (ft amsl) 11/29/2020-12/8/2021**	**Groundwater Elevation (ft amsl) Week of 5/25/202**	**Groundwater Elevation (ft amsl) Week of 1/6/2021**
MW-1	4806.73	Landfill	dry	dry	dry
MW-1B	4807.72	Landfill	4776.82	4776.49	4776.49
MW-2	4800.45	Landfill	dry	dry	dry
MW-2B	4801.72	Landfill	4783.7	4783.4	4783.4
MW-3	4798.45	Landfill	4790.6	4788.83	4788.83
MW-4	4826.47	Landfill	dry	dry	dry
MW-4B	4826.41	Landfill	4788.46	4788.06	4788.06
MW-5	4806.97	Landfill	4779.95	4779.78	4779.78
MW-6	4823.08	Landfill	4791.90	4791.48	4791.48
MW-7	4803.2	Landfill	4783.32	NA	NA
W-1	4801.37	Bottom Ash Pond	4790.965	4791.57	4791.19
W-2	4829.09	Bottom Ash Pond	dry	dry	dry
W-2A	4827.86	Bottom Ash Pond	4801.16	4800.84	4800.79
W-2B	4827.80	Bottom Ash Pond	4791.05	4791.44	4775.54
W-2C	4827.78	Bottom Ash Pond	4800.08	NA	NA
W-3	4807.41	Bottom Ash Pond	4793.51	4795.61	4795.3
W-3B	4810.29	Bottom Ash Pond	4793.24	NA	NA
W-4	4812.47	Bottom Ash Pond	dry	4785.49	4785.88
W-5	4811.89	Bottom Ash Pond	4802.44	4801.37	4803.82
W-5B	4810.62	Bottom Ash Pond	4800.57	4801.04	4799.31
W-6	4807.46	Bottom Ash Pond	4797.45	4798.04	4797.79
W-6B	4807.47	Bottom Ash Pond	4793.07	NA	NA
W-7	4797.54	Perimeter/ Characterization	4790.54	4789.96	4789.8
W-8A	4804.26	Perimeter/ Characterization	dry	dry	dry
W-9	4801.78	Perimeter/ Characterization	4765.91	4765.72	4765.28
W-10A	4835.21	Perimeter/ Characterization	dry	dry	dry
W-10B	4835.22	Perimeter/ Characterization	4807.31	4807.07	4807.19
W-11	4795.99	Perimeter/ Characterization	4772.5	4772.5	4772.38
W-12	4791.65	Perimeter/ Characterization	4769.75	4769.56	4769.72
W-13	4801.96	Perimeter/ Characterization	dry	dry	dry

[1]Wells MW-7, W-2C, W-3B, and W-6B were installed in Nov 2021.

4.2 Water Quality

4.2.1 Landfill/ Ash Disposal Facility

Eight rounds of background groundwater sampling were completed in the updated monitoring network between August and December 2020. Samples were analyzed for Appendix III and IV parameters, plus TSS. Background data from wells MW-3 and MW-5 were pooled to develop the statistical background threshold values (BTVs) for comparing data from the downgradient Landfill wells only. The background sampling and statistical evaluation is described in detail in the Background Water Quality Statistical Certification from June 9, 2021. The first detection monitoring event was conducted on January 6, 2021. Laboratory reports for 2021 are provided in **Appendix C**. In the May 26, 2021 PSCo memorandum, Determination of Statistically Significant Increases over Background per 257.93(h)(2), concentrations of Appendix III COIs from each downgradient monitoring well at the landfill were compared against the BTVs and calcium at MW-4B was found to have an SSI over the BTV. This SSIs triggered the assessment monitoring program for the Landfill.

As stipulated in CCR Rule 257.95(b), within 90 days of the SSI determination an initial assessment monitoring event must be completed. This event was completed in April 2021 and consisted of sampling the Landfill wells for all Appendix IV constituents. Laboratory reports for 2021 are provided in **Appendix C**. In May 2021, the first semi-annual assessment monitoring samples were collected from all of the Landfill monitoring wells with water and analyzed for Appendix III and detected Appendix IV COIs plus TSS.

On August 24, 2021 PSCo completed an Alternative Source Determination (ASD) that described that the SSI of calcium at MW-4B observed during detection monitoring could not be from the Landfill due to the groundwater flow gradient at the Landfill. The ASD also concluded that the source of the calcium is probably related to the different lithology (gypsum) in the screened interval at that well location. Therefore, the Landfill's current status is in detection monitoring. The Appendix III parameters at the Landfill wells during the late May early June sample event was compared to BTVs and all concentrations of Appendix III COIs were below the BTVs, with the exception of calcium at MW-4B.

Between November 18 and December 8, 2021, another semi-annual detection monitoring event was completed at the Landfill. All concentrations of Appendix III COIs were below the BTVs, with the exception of calcium at MW-4B. This parameter at this well is anticipated to consistently have the SSI over BTV for the reasons described in the ASD. Since MW-4B is a cross-gradient well, PSCo intends to revise the network certification to monitor MW-4B only for water levels.

4.2.2 Impoundment

Eight rounds of background groundwater sampling were completed in the updated monitoring network between August and December 2020. Samples were analyzed for Appendix III and IV parameters, plus TSS. Background data from well W-2A was used to develop the statistical background threshold values (BTVs) for comparing data from the downgradient impoundment wells only. The background sampling and statistical evaluation is described in detail in the Background Water Quality Statistical Certification from June 9, 2021. The first detection

monitoring event was conducted on January 6, 2021. Laboratory reports for 2021 are provided in **Appendix C**. In the May 26, 2021 PSCo memorandum, Determination of Statistically Significant Increases over Background per 257.93(h)(2), concentrations of Appendix III COIs from each downgradient monitoring well at the impoundment were compared against the BTVs and several COIs were found to have an SSI over the BTV. At wells W-1 and W-6 there were SSIs for boron and pH and at W-3, W-4, W-5, and W-5B there was an SSI for pH. This SSIs triggered the assessment monitoring program for the impoundment.

As stipulated in CCR Rule 257.95(b), within 90 days of the SSI determination an initial assessment monitoring event must be completed. This event was completed in April 2021 and consisted of sampling the impoundment wells for all Appendix IV constituents. CCR Rule 257.95(h) describes that GPS must be established for each constituent in Appendix IV detected in the groundwater. Results from the April 2021 sample event identified the detected Appendix IV parameters. All Appendix IV parameters were detected in at least one well with the exception of beryllium and mercury. Therefore, GPS are established for all Appendix IV COIs except beryllium and mercury. The upper tolerance limits (UTLs) for the detected Appendix IV constituents serve as the background threshold values (BTV) for assessment monitoring and are displayed in **Table 5**. The Unified Guidance has recommended that the UTL be used as a fixed value similar to a groundwater protection standard where an MCL does not exist for the constituent at the location (USEPA, 2009). The UTL was established based on the eight background sample events at the upgradient monitoring well (W-2A). In accordance with CCR Rule 257.95(h), GPS were established for each detected Appendix IV COI. For each detected COI, **Table 5** lists the EPA established MCL from 40 CFR 141.62 and 141.66, the BTV for the Comanche Bottom Ash Pond, and the GPS. The GPS for each COI is the higher of the two: MCL or BTV.

Table 5. Groundwater Protection Standards for Detected Appendix IV COIs at the Comanche Bottom Ash Pond

Constituent	Unit	MCL (dissolved metals concentration)	BTV (UTL) (total metals concentration)	GPS (total metals concentration)
Antimony	mg/l	0.006	0.000890	0.006
Arsenic	mg/l	0.01	0.0550	0.0550
Barium	mg/l	2	0.0925	2
Cadmium	mg/l	0.005	0.00588	0.00588
Chromium	mg/l	0.1	0.0535	0.1
Cobalt	mg/l	0.006*	0.0102	0.0102
Fluoride	mg/l	4.0	735	735
Lead	mg/l	0.015	0.0132	0.015
Lithium	mg/l	0.040*	5.51	5.51
Molybdenum	mg/l	0.1*	0.0163	0.1
Radium-226-228	pci/l	5^	8.52	8.52
Selenium	mg/l	0.05	3.67	3.67
Thallium	mg/l	0.002	0.00645	0.00645

*EPA adopted health-based value in place of MCL.
^Colorado Water Quality Regulation

On May 25-June 2, 2021, a semi-annual assessment monitoring event collected groundwater samples from all of the Bottom Ash Pond wells and the perimeter wells. Samples were analyzed for Appendix III and detected Appendix IV COIs. In accordance with CCR Rule 257.95(e), downgradient well concentrations were compared against background threshold values. Some COIs were found to be above BTVs. In accordance with CCR Rule 257.95(f), downgradient well concentrations were compared against GPS and were found to exceed GPS. Therefore, following CCR Rule 257.95(g), downgradient well concentrations were compared against GPS to determine “if one or more constituents in appendix IV to this part are detected at statistically significant levels above the groundwater protection standard.”

To determine if an exceedance of a GPS was statistically significant, the 95% lower confidence limit (95LCL) was calculated for each of the downgradient wells for each of the detected Appendix IV COIs. The data used to calculate the lower confidence limit (LCL) was an accumulation of all samples collected at these wells since the establishment of the groundwater monitoring system. The results of the LCL comparison against GPS are provided in **Table 6**. Where an LCL is greater than the GPS the concentration is at a statistically significant level (SSL) over GPS. Downgradient well W-6 (colluvial well) has a 95LCL for molybdenum that exceeds the GPS and perimeter well W-7 has a 95LCL for cobalt that exceeds the GPS. Perimeter well, W-12, consistently had GPS concentration exceedances of cobalt; however, there were only three sample events after the May/June sample event and therefore no LCL was calculated.

Table 6. Lower Confidence Limit from May/June 2021 Sample Event Compared to Groundwater Protection Standard for the only Detected Appendix IV COIs that Exceed the GPS			
Monitoring Well	**Appendix IV Constituent**	Cobalt	Molybdenum
	Unit	mg/l	mg/l
	GPS	0.0102	0.1
W-6 (Colluvial Downgradient Well)	**95% LCL**	--	0.298
W-7	**95% LCL**	0.016	--

On November 29 to December 9, 2021, another semi-annual assessment monitoring event collected groundwater samples from all of the Bottom Ash Pond wells and the perimeter wells. Samples were analyzed for Appendix III and detected Appendix IV COIs. In accordance with CCR Rule 257.95(e), downgradient well concentrations were compared against background threshold values. Some COIs were found to be above BTVs. In accordance with CCR Rule 257.95(f), downgradient well concentrations were compared against GPS and were found to exceed GPS. Therefore, following CCR Rule 257.95(g), downgradient well concentrations were compared against GPS to determine "if one or more constituents in Appendix IV to this part are detected at statistically significant levels above the groundwater protection standard." The results of the LCL comparison against GPS are provided in **Table 7**. Downgradient well W-6 (colluvial well) has an SSL of molybdenum over GPS. Perimeter well W-7 has an SSL of cobalt over GPS. Concentrations of cobalt are consistently over GPS at perimeter well W-12 after four sample events.

Table 7. Lower Confidence Limit from Nov/Dec 2021 Sample Event Compared to Groundwater Protection Standard for the only Detected Appendix IV COI that Exceeds GPS			
Monitoring Well	**Appendix IV Constituent**	Cobalt	Molybdenum
	Unit	mg/l	mg/l
	GPS	0.0102	0.1
W-6 (Colluvial Downgradient Well)	**95% LCL**	--	0.296
W-7 (Perimeter Well)	**95% LCL**	0.0160	--

Newly installed downgradient wells at the impoundment waste boundary, W-3B and W-6B, were not included in the statistical analysis because only one sample event occurred in 2021 in late November/early December. However, there were boron concentration exceedances over BTV at these two wells that are screened in weathered shale. For Appendix IV COIs, both wells also had one-time concentrations over GPS for cadmium and cobalt.

5.0 Summary

The following observations are based on CCR Rule compliance monitoring data collected during 2021:

Landfill/ Ash Disposal Facility

- A total of ten monitoring wells are in the certified Landfill monitoring network for CCR compliance: MW-1 through MW-7, plus MW-1B, MW-2B, and MW-4B.
- One well, MW-7 was installed in November 2021 downgradient of the Landfill waste boundary in the weathered shale.
- Detection monitoring sampling was collected from all non-dry wells in January, April, May/June, and November/December 2021. On each sample date the only SSI detected was calcium in MW-4B. PSCo developed an ASD on August 24, 2021 that described that there was an alternative source for calcium in MW-4B, and it was not from the Landfill.
- In 2022, PSCo will continue detection monitoring at the Landfill.
- In 2022 the Groundwater Monitoring Network Certification will be updated to reflect MW-7 (drilled in 2021) being added into the certified monitoring network.

Bottom Ash Pond/Impoundment

- Eleven wells are in the certified monitoring network for CCR compliance of the bottom ash impoundment: W-1, W-2, W-2A, W-2C, W-3, W-3B, W-4, W-5, W-5B, W-6, and W-6B; plus six perimeter wells: W-7, W-8A, W-9, W-11, W-12, and W-13; plus additional water level only wells.
- PSCo installed three new wells at the impoundment monitoring network in November 2021, W-2C (background), W-3B, and W-6B.
- Detection monitoring was completed in January 2021 and SSIs were identified.
- GPS were developed for the impoundment.
- Assessment monitoring was completed in April 2021 and again in May/June 2021. SSLs of molybdenum at W-6 and SSLs of cobalt at perimeter well W-7 were determined in both sample events. Perimeter well W-12 also has concentrations of cobalt consistently higher than GPS.
- In 2022, PSCo will complete background monitoring at new monitoring well W-2C and will continue assessment monitoring at the Bottom Ash Pond.
- In 2022, PSCo will publish an Assessment of Corrective Measures.
- In 2022 the Groundwater Monitoring Network Certification will be updated to reflect the new wells drilled in 2021 that are being added into the certified monitoring network.

6.0 References

HDR, 2015. Groundwater Sample Collection Standard Operating Procedure. October 28, 2015.

HDR, 2021. Groundwater Monitoring System Certification - Compliance with the Coal Combustion Residuals Rule Comanche Station. June 28, 2021.

HDR, 2021b. 2021 Annual Groundwater Monitoring and Corrective Action Report. January 29, 2021.

HDR, 2019a. Data Management and Statistical Procedures Plan for Compliance with the Coal Combustion Residuals Rule. Updated July 7, 2019.

GeoTrans, Inc., 2009. Surface Water Impoundment Infiltration Characterization Analysis, Public Service Company of Colorado, Comanche Station, Pueblo, Colorado. December 1, 2009.

Tetra Tech, 2012. Inventory and Preliminary Classification Report, Waste Impoundments, Comanche Station, Pueblo, Colorado. November 1, 2012.

Tetra Tech, 2013. Closure Plan, Type A Waste Impoundments, Comanche Station, Pueblo, Colorado. June 28, 2013.

Tetra Tech, 2014. Sitewide Monitoring Plan, Ash Disposal Facility, Comanche Station, Pueblo, Colorado. August 29, 2014.

Tetra Tech, 2015. Engineering Design and Operations Plan, Ash Disposal Facility, Comanche Station, Pueblo, Colorado. January 13, 2015.

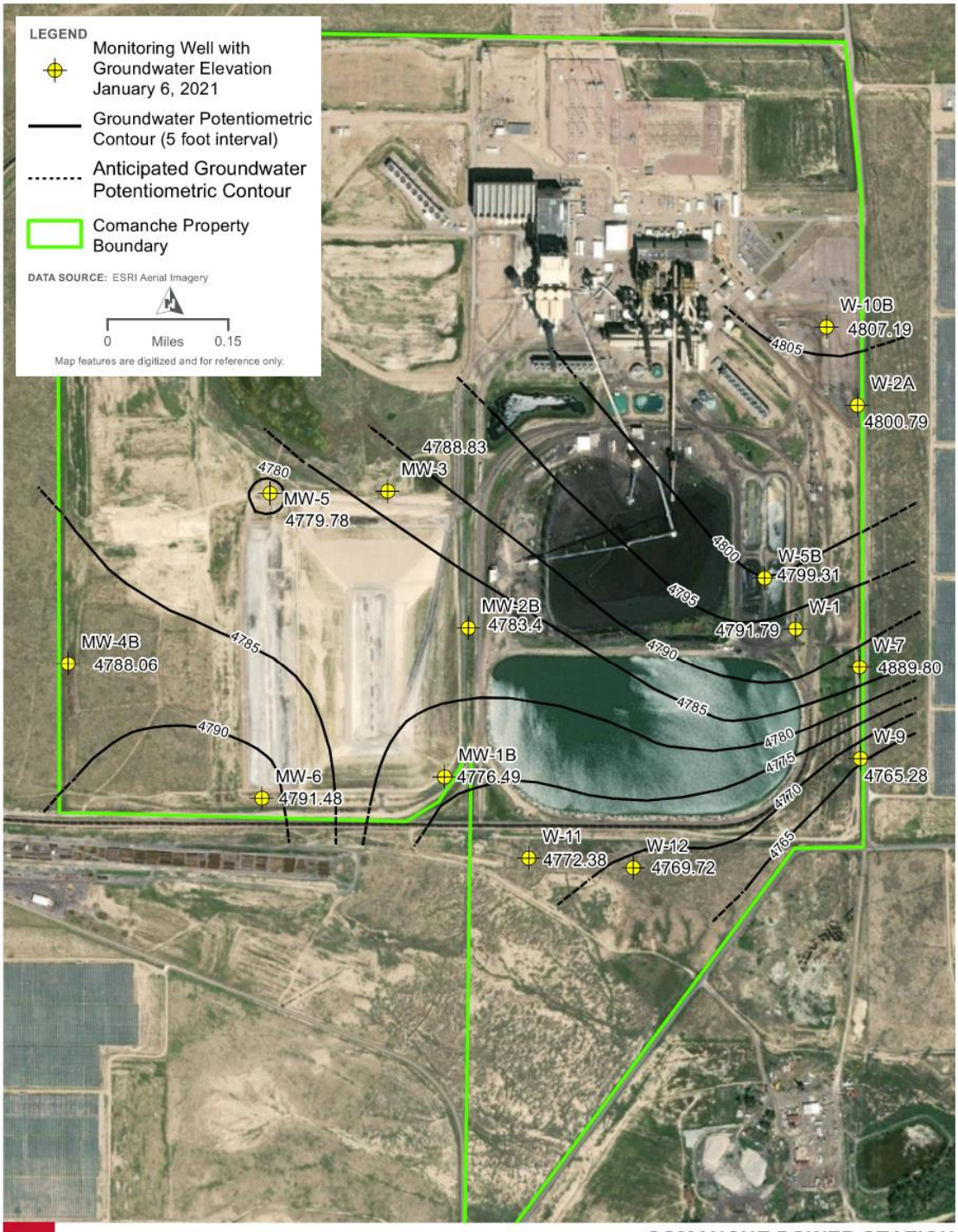
URS, 2005. Geotechnical Investigation, Unit 3, Comanche Station, Pueblo, Colorado. March 2, 2005.

Woodward-Clyde Consultants, 1987. Feasibility Investigation, Two Ash Disposal Areas for Comanche Power Station, Pueblo, Colorado. March 1987.

Xcel Energy, 2005. Comanche Station Coal Ash Disposal Facility Design and Operations Plan. August 24, 2005.

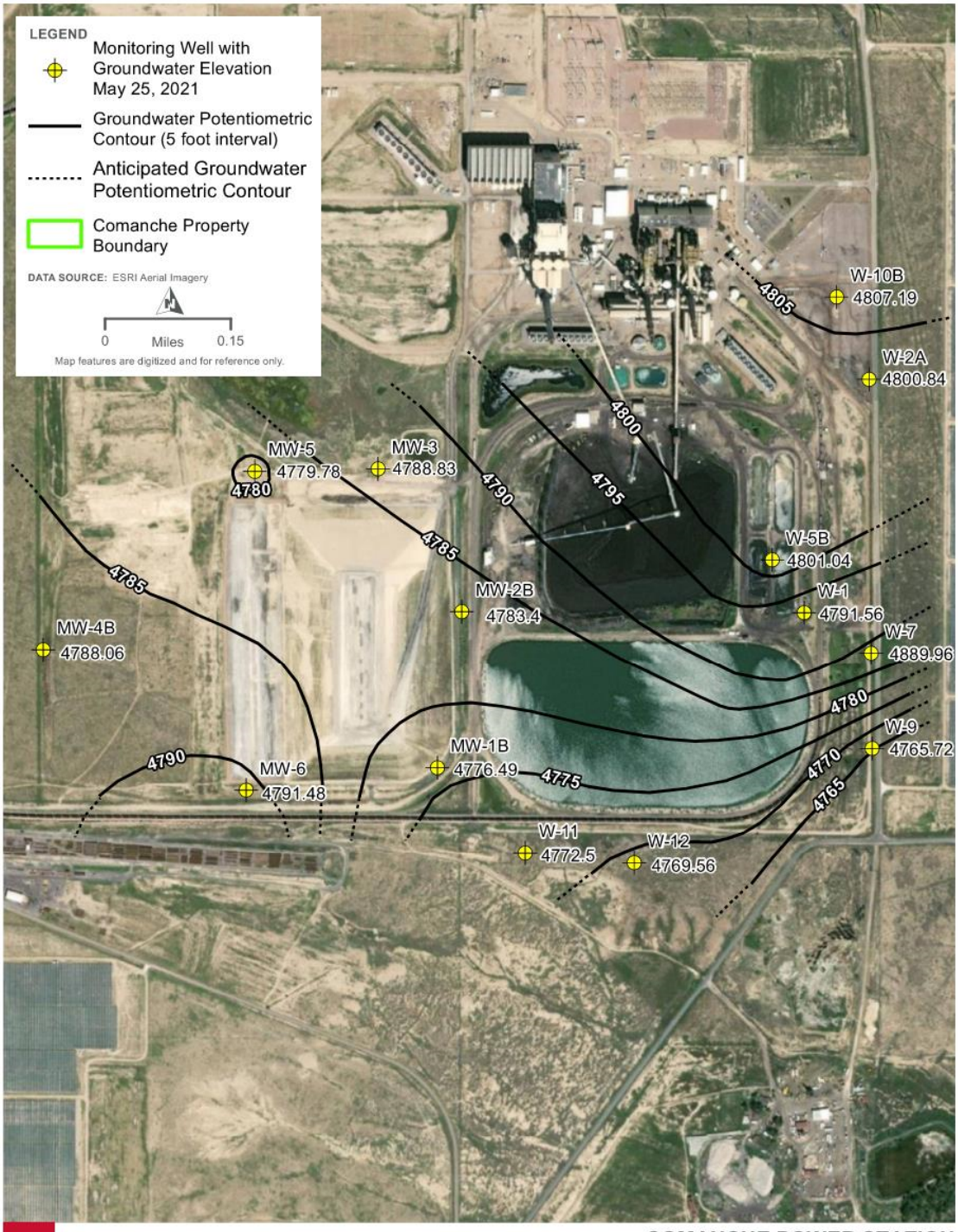
Appendix A

Potentiometric Surface Maps



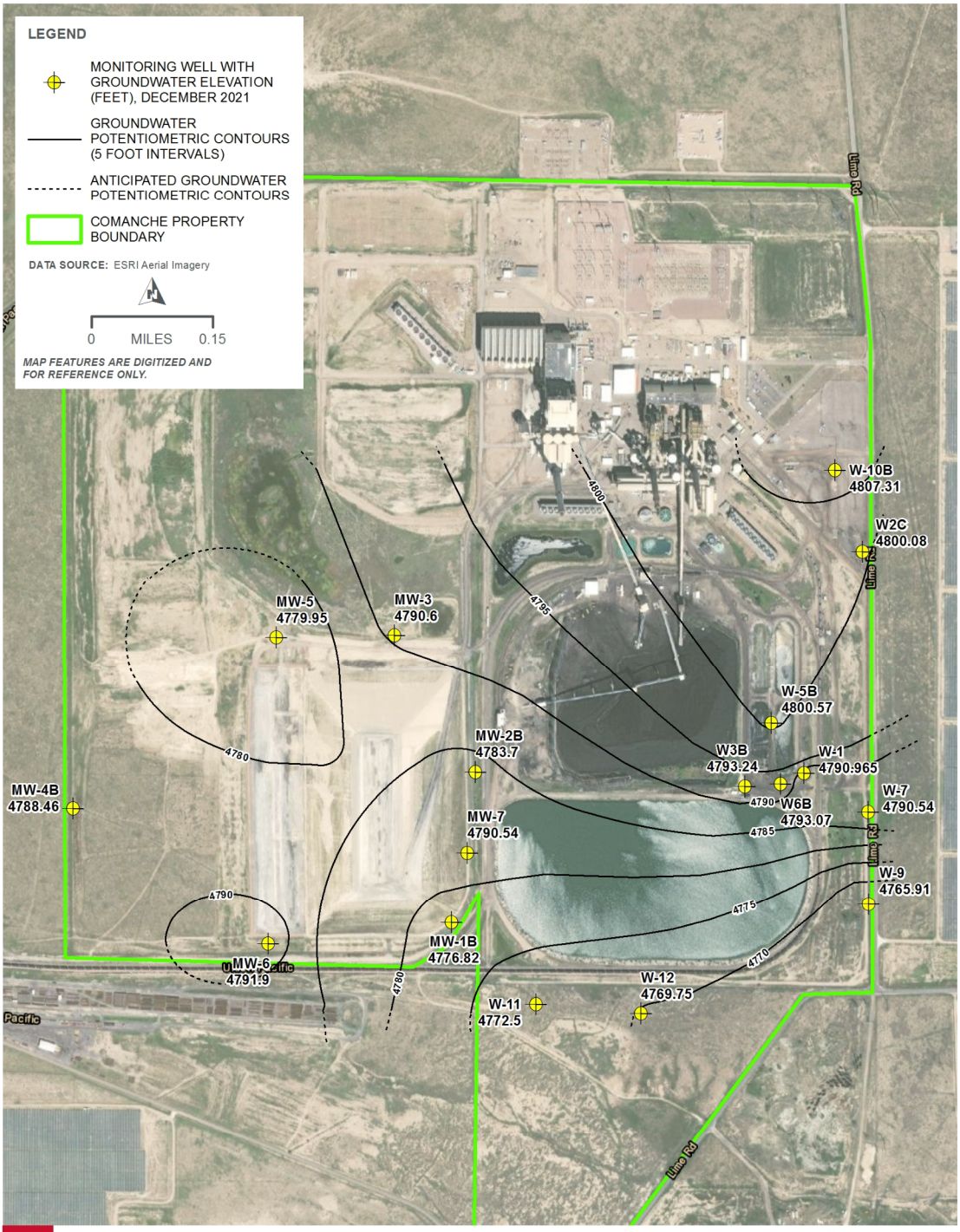
COMANCHE POWER STATION
PUEBLO COUNTY, CO

PATH: C:\USERS\TBUSZKA\DESKTOP\COMANCHE SUPORT FILES\PLP SAMPLES\GW CONTOUR_JAN2021.MXD - USER: TBUSZKA - DATE: 8/23/2021



COMANCHE POWER STATION
PUEBLO COUNTY, CO

PATH: C:\USERS\TBUSZKA\DESKTOP\COMANCHE SUPORT FILES\PLP SAMPLES\GW CONTOUR.MXD - USER: TBUSZKA - DATE: 8/23/2021



COMANCHE POWER STATION

PUEBLO COUNTY, CO

PATH: J:\2015\15-115_XCEL_CORE_SAMPLING_TESTING_(WALTHER)\MAP_DOCS\GROUNDWATER_CONTROURS\COMANCHE_GWCONTOUR_DEC2021.MXD - USER: AKAPLE - DATE: 1/5/2022

Appendix B

Monitoring types to comply with specific CCR Rule requirements

Monitoring types to comply with specific CCR Rule requirements			
Type of Monitoring	**Description**	**CCR Rule Reference**	**Constituents Analyzed**
Background Monitoring	Development of background water quality conditions for Appendix III and Appendix IV COIs	257.94(b)	Appendix III and IV and TSS
Detection Monitoring	Semi-annual detection monitoring for Appendix III COIs	257.94(c)	Appendix III
Assessment Monitoring	Detailed types below.	257.95	Detailed types below.
➢ Initial Assessment	Determining detected Appendix IV COIs	257.95(b)	Appendix IV
➢ Semi-Annual Assessment	Semi-annual assessment monitoring for Appendix III and detected Appendix IV COIs	257.95(d)	Appendix III and detected Appendix IV plus TSS
➢ Annual Assessment	Determining detected Appendix IV COIs on an annual basis. Starting in 2019 this will also count as the semi-annual sample event.	257.95(b)	Appendix III and all Appendix IV plus TSS
➢ Release Characterization Assessment	Occurs after detection of SSL above the GPS for the purpose of characterizing the nature and extent of the release.	257.95(g)(1)(iv)	Appendix III and detected Appendix IV plus TSS
➢ Corrective Action Assessment	Occurs after a facility has initiated corrective action. This is an PSCo designation (not in the Rule) added to Assessment Monitoring to differentiate that the samples were collected after the corrective action has been implemented.	N/A	Appendix III and detected Appendix IV plus TSS
Post-CCR Removal Monitoring	Occurs after the facility has been physically closed (e.g. all CCR waste removed from the impoundment). This is an PSCo designation added to other types of monitoring (e.g. Background Monitoring or Detection Monitoring.	N/A	Appendix III and/or Appendix IV as applicable plus TSS
Closure Confirmation Monitoring	Occurs after the facility has been closed (e.g. all CCR waste removed from the impoundment) in compliance with CCR Rule for certification of Clean Closure.	257.102	Appendix IV

Appendix C

Laboratory Reports